Why is datacenter network modernization necessary, and what does it involve?

As never before, applications set the agenda for IT infrastructure. With application architectures shifting from traditional monolithic software to cloud-native microservices, the need arises for infrastructure modernization in datacenters. IDC refers to this form of modernization as digital infrastructure, which provides optimization, innovation, and resiliency through autonomous operations, cloud technologies, and ubiquitous consumption.

The datacenter network, as part of digital infrastructure, must respond to the modernization imperative. Enterprises are requiring the network to become more agile, more flexible, more responsive, more programmable, more reliable, more elastically scalable, and more attuned to the nonstop innovation associated with DevOps and continuous integration/continuous delivery (CI/CD) pipelines. The datacenter network and its on-premises operators must become more like the cloud.

To become more cloudlike, companies understandably look to the cloud giants for datacenter inspiration and guidance. Leading enterprise IT organizations see the value of highly automated scale-out architectures and strive to adopt and emulate hyperscale best practices – in architectures, infrastructure, and operating models – but they want to do so on their own terms, with products and technologies adapted to their requirements and environments. The result should be highly orchestrated and automated networks capable of operating at scale, with all the agility, flexibility, programmability, and observability required to speed application and service deployment and keep critical applications and services running at high levels of availability and resilience.
**Q. What role does the network operating system play in achieving datacenter network modernization?**

**A.** Network operating system (NOS) software is a foundation element of a modern, intelligently automated network. Linux has become the gold standard for network operating systems in the datacenter. A modern datacenter NOS, built on Linux and featuring a microservices design and a modular model-driven architecture, is essential. Such a NOS offers modularity, flexibility, programmability, elastic scalability, enhanced visibility and observability, modern protocol support, and the ability to be managed with the same Linux tooling used across servers and other datacenter infrastructure.

That also means that a modern Linux datacenter NOS complements and adds to a NetOps platform and operating model that closely mirrors and complements DevOps processes and CI/CD pipelines. These help to bridge the long-standing divide between the network and the applications it supports and delivers. Similarly, the modularity and microservices design of a Linux datacenter NOS contributes to continual software updates without disruptions to system stability or application availability. A microservices-based Linux datacenter NOS also provides well-defined interfaces for seamless integration with cloud orchestration systems, and it is a natural complement to cloud-native microservices environments, including Kubernetes.

Finally, an extensible and feature-rich NOS SDK enables network teams to rapidly develop applications for enhanced network operations. If architected properly, a modern NOS should also facilitate access to rich, real-time stateful telemetry, providing a steady stream of timely and actionable data, allowing network teams to proactively manage the entire datacenter network in support of applications and services.

**Q. What about the orchestration and management layer? What capabilities should it provide?**

**A.** Datacenter network automation, long seen as inevitable, is now undeniable. Orchestration and intelligent network automation is integral to any modern datacenter network — not just on day 0 and day 1 but throughout the network life cycle. The management layer or plane should provide a single source of truth for every step of the network-automation life cycle. Intent-based templating makes it possible to achieve operational simplicity while also reducing the need for many mundane, repetitive tasks that are subject to costly human error. The management plane thus ensures that the network adheres to a consistent, predictable, and continuous closed-loop process, providing simple integrations to cloud management systems.

In IDC’s enterprise interactions and research, we invariably find that organizations want a modern datacenter network fabric to feature simple and agile orchestration as well as automation at every step of the process, from pre-production validation and verification of network planning and design (using a sandbox or digital twin) through to extensively automated day 1 provisioning and deployment. Also important are deep and pervasive visibility and observability to support day 2 operations in addition to closed-loop change management and prescriptive optimizations that continually improve the efficiencies and business outcomes supported by the network.
The digital twin, which emulates both configuration and state, can provide value throughout the entire workflow of the network life cycle. On day 0, for example, the digital twin provides validation of the underlay design. On day 1 deployment, it provides validation of the overlay network design. On day 2 and beyond, the digital twin can be integral to CI/CD closed-loop automation, validating all network configuration changes and software updates before they are made.

In achieving this full life cycle of intelligent network automation, modern datacenter networks and their operators obtain a pipeline approach to datacenter NetOps that is analogous to the CI/CD process of DevOps: trial, validate, deploy, monitor, analyze, and optimize. Unfortunately, many organizations make the mistake of automating partially or only on day 1, using scripts or a configuration-automation platform. However, day 2 is the rest of a network’s life, and it's important to ensure that automation goes beyond configuration and deployment to support availability, uptime, and the continuous processes of digital business.

Q. **Software is the cornerstone for automation and orchestration. Is there still a meaningful role for datacenter network hardware?**

A. Although software contributes hugely to datacenter network automation, modern network hardware also has a valuable role to play. To support modern applications, datacenter networks typically encompass optical components and optical networking, as well as robust IP routing capabilities, especially in hybrid scenarios that extend to WAN contexts and datacenter interconnect (DCI) scenarios. Connecting simply, effectively, scalably, and securely to public clouds is essential for any organization pursuing hybrid cloud or multicloud strategies, and network hardware helps make that happen.

In addition, datacenter network hardware can contribute to sustainability initiatives and "green IT." Given volatile energy costs and environmental concerns, considerable emphasis is now placed on the energy and space efficiency of datacenter infrastructure, including network devices. This is particularly true in relation to greenfield environments and new datacenter builds.

The combination of the right standards-compliant hardware and software confers simplicity and flexibility too. Flexibility allows for choice, and it helps to ensure overall resiliency. High-performance hardware platforms, with flexibility in underlying network silicon and the capacity for disaggregation, are important pieces of the puzzle.

Q. **If organizations modernize their datacenter network completely, what benefits can they expect?**

A. As a result of full-life-cycle intelligent automation of the datacenter network, a range of compelling benefits can be realized.

A thoroughly automated network confers network agility, and it allows the network and its operators to keep pace with applications and the application developers that are closely aligned with the needs of digital business. Further, network flexibility provides the adaptability required by the digital business and the broad array of applications on which it depends.
Those are valuable benefits, of course, but an added bonus is the peace of mind that comes from knowing that network automation is used at every stage of the network life cycle to pre-validate and ensure scenario planning across the full spectrum of datacenter network infrastructure. By simulating and confirming the efficacy of configurations and changes offline, before they are implemented in production environments, organizations can significantly mitigate risks associated with upgrades or the deployment of new applications.

Associated benefits are increased NetOps efficiency and productivity, which help organizations do more with less while also facilitating redeployment of resources to innovative initiatives and the furtherance of strategic objectives rather than relatively low-value repetitive tasks.

In the final analysis, a modern datacenter network makes a direct and material contribution to the realization of digital business objectives and outcomes. This is a welcome departure from the traditional perception of the network as a cost center and obstacle to agile application development, new and better digital services, and competitive advantage.

About the Analyst

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Brad Casemore is IDC’s Research Vice President, Datacenter and Multicloud Networks. He covers datacenter network hardware, software, IaaS cloud-delivered network services, and related technologies, including hybrid and multicloud networking software, services, and transit networks. Mr. Casemore also works closely with IDC’s Enterprise Networking, Server, Storage, Cloud, and Security research analysts to assess the impact of emerging IT and converged and hyperconverged infrastructure.
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